GUIDE TO THE COMPUTER PRODUCTION OF RANDOMIZED EXAMINATIONS

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Section 1, Introduction:

With increasing crowding of classrooms and increased teaching loads, it becomes evermore difficult for the instructor to provide examinations which obviate the possibility of student transcription, and which are not too similar to previous examinations possibly in circulation, without going to forms which are either very difficult to write or difficult to grade. To aid some in this area, we have produced a program for randomizing objective type examinations,\(^6\) which is now in use in several nearby schools. This program is designed to minimize labor on the part of the instructor, both in preparation and in correction, while at the same time designing examinations so that breaches of security are rendered difficult. The program has been kept small enough to be used at schools with even the most modest computer facilities.

We have avoided the common five-part examination because these are notoriously difficult to write, and often require considerable screening before five appropriate answers can be chosen.\(^3\) Instead, we have gone to the "choice from a list" type of examination because, with any reasonable sized list of answers, the problem of random selection of correct answers essentially vanishes. It is also possible to render this type of examination random in many of its features, so that each student receives a copy peculiar to him, even though the material covered is the same. At the same time, it makes it possible for the instructor to write such an examination easily, and to have it corrected with equal ease.
In brief, the instructor simply writes down, in straight text, the material which he wishes to cover. He then returns and circles those key words which he wishes to have extracted, and to be understood as answers in context. At the same time he indicates, on a separate line, the number of copies he desires, the number of questions contained in the text, and the number of master copies he wishes to receive. The master copies contain his original text with the questions and answers printed in full, so that he can rapidly check questions against answers. He also indicates whether he wishes the number sequence of questions to be scrambled, and whether, and how, he wishes the text to be scrambled. Finally, he selects two code numbers, known only to himself, which govern the scrambling of answer codes and student codes. These scramblings utilize a random number generator of known randomness which is always available in its entirety to the instructor, but which is controlled in its output entirely by the key numbers which he employs. This information is then conveyed to the data center, which punches up the appropriate cards, and the resultant master copies and student copies are given back to the instructor.

An example of such a quiz is shown in Figure 1. In this particular example, both the sequence of questions numbered within the text, and various sentences of the text, are scrambled from one student's copy to another. The answer list, however, remains the same. We normally list it in alphabetical order so as to facilitate the students location of the correct answer with a minimum of clerical time.

The first two lines contain instructions to the student and, at the far right, an examination identifier to be used during corrections (as described)
below). The second line contains the title of the examination, the date, and the student's name, as well as the student's code number, printed twice. On the left hand section of the page is the text, with the missing words or phrases indicated by two pairs of asterisks, with the question number between them. The answer list follows to the right. After each answer is a random answer code which is unique not only for that answer but also for the particular student. Thus, a student transcribing one of these codes from a neighbor would not only invariably have an incorrect answer, but one from which the computer could always determine, by rechecking the random number sequence, the student from whom he had transcribed it.

Space for the answer then follows to the right and, on the far right, are listed the correct answer codes corresponding to these questions. In use, this strip to the far right is removed with a paper cutter and saved for the corrector. At the head of each strip is the indicator which identifies the examination, so that a corrector who has many different examinations from many different courses will not be in confusion. This is followed by the student code number, which must match the student code number of a student's own sheet. During hand correction, the corrector simply aligns this strip with the student's answer strip, moves vertically down the column to correct them, determines the grade, and records it. Recording and processing of grades may also be computerized, if desired, using a system described elsewhere.²

The format shown here is only one of a large number of options available to the instructor, and different arrangements may be elected. Also, if the instructor has an appropriate list of students' names, these may be inserted
automatically from a list given to the data center, if so desired. Thus, during the term, there will always be a unique relationship between the student's code and the student's name. This relationship is under the control of the instructor, however, and need be known only by him if he so desires, e. g. it may be changed from quiz to quiz without loss of information.

This kind of quiz may also make reference to external material, e. g. graphs or tables handed out as reproduced sheets, or drawn on the blackboard. Examples of this are included in Figure 1. In addition, if the instructor desires that a particular numerical answer be calculated by the student and entered, this is also feasible. In this case, the random number code is replaced by the correct numerical answer on the corrector's strip and by a blank, plus the legend "numerical answer", on the student's copy of the same.

We have found, over the course of the last several years, that students adapt to this type of examination very quickly. Invariably, they master its clerical aspects within one, or at most two, practice sessions.

The student, as he takes the examination, simply identifies the question number to be supplied with the appropriate word or phrase, locates the correct word or phrase in the list, and copies its code into the blanks that correspond to that question number.

If the quiz is relatively unscrambled, i. e. the question numbers begin with one and run through linearly to the end, we have found that the clerical
time involved in matching answer to question is about six minutes, if the student knows all the answers. This was tested by giving students an examination, correcting it and returning it to them. They were then informed, a week later, that they would receive the same examination over again, and that they were to fill it out as quickly as they could. However, because the answer codes are random numbers, the answer codes themselves would not be the same on the two successive examinations. Thus, it was necessary for them to actually locate the answer and copy down its new code; i.e., it was not possible simply to copy the codes from the old quiz directly down the column. When the questions were more scrambled, i.e., the numbers of the questions were not in simple linear order, the average clerical time involved was about nine minutes. We generally allow one minute per question, so that this investiture of about 0.15 minute in clerical time per question compares favorably with the amount of clerical time involved in the more common five-part examination.3

The particular example given is from a pathology course in Neoplasms. However, we have utilized similar examinations for courses in clinical genetics, physiology, infectious diseases, nutrition, biophysics, radiation biology, and biochemistry. In all cases, student acceptance was extremely high, and complaints of misgrading or misunderstanding averaged something less than 1/2 percent. At the same time it permitted us to administer quizzes at least once a week, in each of a number of courses, to student groups ranging from 30 to 120 per course.

Clearly, some security must be maintained over copies of the examination before it is given, since it does clearly outline the material that will be covered. However, even possession of a master copy during the examination itself
would avail the student relatively little because of the difficulty of translating the random order of his own copy into that of the master copy.

Thus, we have found this type of examination to offer marked advantages, in terms of ease of grading and make-up for the instructor, as well as relatively less stringent requirements on examination security than is often necessary with other sorts of examinations. Although the examples shown here are graded by hand, it is possible to adapt the same type of examination easily to standard computerized grading forms of the type possessed by some educational institutions or to IBM Port-a-Punch systems.\textsuperscript{2}
Section 2, The Program:

A complete program and data listing is presented in Figure 2. Each list entry corresponds to one card, and each such card has been given a card number at the far left.

Card 1: Place the job control cards particular to the data center in use.

Cards 2-21: Comment cards briefly explaining the input and its format.

Cards 22-25: Logical 1 declaration and dimension statements. Since most of the input data is of single byte characters, Logical *1 reduces the needed program space.

Cards 26-46: Format statements used in reading data, and printing output.

Card 48: Instruction to read into the computer the symbols used for numerals, *, %, -, and blank. By reading these, they will be automatically converted to the machine representation particular to the computer being used.

Cards 49-63: Clear storage spaces reserved for variables to be read from the data set.

Cards 68-80: Read examination title, control card, text, answers, and the list of student names, if used.
Cards 81-100: Master copies are organized and printed.

Cards 101-108: Advances random number generator by the value of NSR.

Cards 109-121: Locates %% points indicated by instructor, as starting points for text scrambling, then blanks out the %% from the text.

Cards 122-135: Locates the positions of the question numbers in the text and stores their locations.

Cards 136-148: The locations of %% and **, and the locations and values of numerical answers, are printed for instructor reference.

Cards 149-233: Assemble and print tests.

Cards 156-175: Questions are renumbered for each test unless inhibited by JN read at card 69.

Cards 176-196: Text is shifted ("scrambled") unless inhibited by JT read at card 69.

Cards 197-233: Test is printed, along with instructions to students, test title, student name (or blank for name), text, and answer
choice list. Correct answer strip is printed at far right, headed by test identifiers.

Program then recycles to card 149 to process and print next test. When NSTUD tests have been printed, program exits at 235.

A flow diagram is presented in Figure 3 keyed to the card numbers of the listing in Figure 2.
Section 3, Input Data:

Card 237: Job control cards as required by local data center.

Card 238: The standard symbol list. Variables are named and listed, with their dimension in parentheses if >1.

MM(10) = the number symbols, 0-9.

LSF1 = symbol to identify question numbers, usually *.

NB = the blank symbol.

LSF2 = symbol to identify the start of a text scramble section, usually %.

LD(5) = string of five dashes for answers.

Format is A1, i.e., one column per symbol.

Card 239: Used to enter examination title and identifiers to appear above correction strips.

LP(40) = Exam title, 40A1, i.e. the first 40 columns are referred for title.

LE(12) = Identifiers. These are grouped into two lines of six characters each when printed. Thus, columns 41-46 and 47-52 will be printed as two identifiers above one another over the correction strip. Format 12A1.
Card 240: Enters copy and scramble control.

NSTUD = Number of copies desired, 15 in the example.
NQS = Number of questions asked, 50 in the example.
NS = Code number shift. In the example = 9, i.e. the first student paper will be code 9, and the rest will follow in numerical order. The example is code nr.20.
NSR = Random number shift. In the example = 13, i.e. the random number string will be advanced 13 along the string beginning with the initial number 3125 (as set in program at card 54).
NMS = Number of Master copies desired, 1 in the example.
JN = Renumber control. If 0 or blank the question numbers will be scrambled from copy to copy. Any other entry will inhibit this scramble.
JT = Text scramble control. If 0 or blank the text will be progressively scrambled at each %% entry. Any value other than 0 or blank will inhibit this scramble.

Format is 7I5, i.e. the values above must be right adjusted to columns 5, 10, 15, 20, 25, 30, 35.

Cards 241–290: Text cards, as punched by data center with question numbers (**01**, etc.) in place of answers. There must be 50 cards. Those in excess of text are simply blank cards. LQ(4000) = the text array, 50 cards of Format 80A1.
Cards 291-340: Answer cards. The question number corresponding to this answer is of Format I2, i.e. must be right adjusted to column 2. The answer follows in Format 20A1, i.e. any 20 characters. These are extracted from the circled text given by the instructor. At each circled location the data center extracts the question number for columns 1, 2 and the answer (up to 20 spaces) for columns 3-22.

LAA(50) = The question number, up to 50 questions.
LA(50,20) = The answer array, up to 50 answers of up to 20 characters each.

Cards 335-340: Where a numerical answer is desired that is to be computed by the student, LAA remains as above. LA is inserted as the phrase NUMERICAL ANSWER, or FIGURE CHOICE, and these legends will appear on the student paper in place of the usual verbal answer. In order to invoke this function the variable LNA(50) must be inserted after LA. LNA is the correct numerical answer, any combination of digits up to 99999. Format is I5, i.e. LNA must be right adjusted to column 27. Thus, LNA may represent an arithmetically computed answer, as on cards 335-338. Or, it may represent a choice number from graphical or other material supplied by the instructor.
Card 341: Name list. Up to 200 student names may be entered here, on separate cards. These will appear in place of the dashes given after NAME = at the top of the example. NAME(200,40) in Format 40A1, i.e. 40 spaces are allowed for each student name. If the number of copies requested, NSTUD, is greater than the number of student name cards supplied, the additional copies will be printed without name, as in the example.

Card 342: An obligatory blank card, which signals termination of the data set, and of the run.
Section 4: Program Modifications and Discussion:

In the program shown in Figure 2, the random numbers are truncated to four digits before being used as answer codes. Thus, by chance, the same four digit code will appear twice on about one student's paper out of a hundred. We have found that it is simplest to ignore this effect, and to instruct the student to simply use the answer codes as if no duplicate existed on his paper. At worst, this would allow the student to have these two answers interchanged and "incorrect," and still receive credit for each. However, even this possibility is extremely unlikely, since such pairs occur with only random correlation to answers, when they occur at all. If the user felt that this remote possibility was, nonetheless, unsettling, the program could be modified by storing the random answer codes for each student's sheet while that sheet was being produced (i.e., in the loop from card 216 to card 225 of Figure 2). An additional check loop could be inserted here and, if a duplicate answer code were detected, it could be rejected and the random sequence advanced one in compensation.

The random number generator itself is of the congruential type⁴,⁷ adapted, in this case, to the 32-bit word of the IBM-360/370 systems. It is shown on cards 105-107 of Figure 2, with the initial value set at card 54. Modifications to fit other word types are given in the literature.⁴,⁷

The test format shown in Figure 1 may be changed quite simply by changing array dimensions and the corresponding FORMAT statements. In all, 100 spaces are presently allowed for text and answer on each line in what might be called an 80 + 20 format, i.e., 80 spaces for text and 20 for answers. A different apportionment is obtained as follows:
1. Let the new number of allowable spaces per answer = NA.

2. Then NQ = 100 - NA, where NQ is the number of characters available for text.

3. Then the total text array size must be 50 * NQ, since there are 50 lines available.

4. Whereupon the following changes are to be made on cards 25, 38, 40, 97, 98, 112, 125, 188, 192, 193, 194, 229, 230:
   - 20 is replaced by NA
   - 80 is replaced by NQ
   - 3999 is replaced by (50 * NQ) - 1
   - 4000 is replaced by (50 * NQ)

Making these changes, for example, one could render each line of text a short question in its own right with, as needed, fairly long answers. Or, similarly, one could use a 50-50 format for a matching type of test where each entry in the first column of \( \leq 50 \) characters was to be matched to one of the entries in the second column of \( \leq 50 \) characters.

Should the number of names in the allowed name list exceed 200, it is only necessary to change the 200 dimension of the NAME (200,40) array on card 24 to the desired value.

Finally, the entire width used may be decreased, say to the 8-1/2 inches of a standard 8-1/2 x 11 sheet. 8-1/2 inches corresponds to 85 characters on a standard printer. At present, a total width of 130 characters is employed, 100 for text and answer, and the remaining 30 for spaces, codes, etc. At 85 total, this would leave 55 characters for text + answer, and this could be accommodated by the system outlined above with 55 replacing the 100. The present vertical size is 11 inches, so no change would seem to be indicated there. However, this 11 inches utilizes 60 lines vertically,
10 for heading, etc., and 50 for text + answer. Thus, modification vertically would only require substitution of the 50 used in the system outlined above by the desired number of lines.
Figure 1: Sample examination, from a course in neoplasms using Robbins\textsuperscript{5} and Ackerman\textsuperscript{1} as texts. A student copy is shown, before removal of the correction strip (far right). The first 40 questions are of the straight-text type, and the last 10 are referred to tabular/graphical material handed out as reproduced sheets, or placed on the blackboard. Questions 03, 06, 07, and 10 are of the numerical-answer type. Both paragraph order and question-number order were scrambled, in this particular example, independently of one another. Thus, another student would receive a copy with paragraphs different from these, and question numbers also different, even for the same text sentences.
BRONCHOGENIC CARCINOMA IS **11** AMONG THE GREAT VARIETY OF TUMORS OF THE LUNG. THERE IS A DIRECT CORRELATION BETWEEN THE FREQUENCY OF LUNG CANCER AND THE AMOUNT OF **12** SMOKING.

Carcinomas arise most often in and about the hilus of the lung and breast. These lesions are most **14** in all forms and have the poorest **15**. The clinical manifestations of bronchial adenomas and carcinomas are as follows:

1. Increased numbers of cases of so-called pulmonary **16** have been identified.
2. It is estimated that **17** or **18** of the population may develop some degree of chronic respiratory disease.
3. The major clinical presenting complaints are:
   - **18** cough
   - Hemoptysis
   - **19** emphysema
   - Diagnostic significance for this will be **20**.

The malignant neoplasms of the larynx are almost invariably **21** cell CA. **22** is the most common site of visceral malignancy in Western man. The clinical manifestations of bronchial adenomas and carcinomas are as follows:

1. Increased numbers of cases of so-called pulmonary **23** have been identified.
2. It is estimated that **24** or **25** of the population may develop some degree of chronic respiratory disease.
3. The major clinical presenting complaints are:
   - **26** cough
   - Hemoptysis
   - **27** emphysema
   - Diagnostic significance for this will be **28**.

In the pleura the most common form of malignancy is **29**.

1. Their capacity to **30** and the ability of some of these lesions to elaborate **31** are all **32** of the intraluminal growth of these lesions.
2. In the pleura the most common form of malignancy is **33**.
3. The clinical manifestations of bronchial adenomas are as follows:
   - **34** cough
   - Hemoptysis
   - **35** emphysema
   - Diagnostic significance for this will be **36**.

The primary sites of metastases of **37** are the **38**. The malignant neoplasms of the larynx are almost invariably **39** cell CA. **40** is the most common site of visceral malignancy in Western man. The clinical manifestations of bronchial adenomas and carcinomas are as follows:

1. Increased numbers of cases of so-called pulmonary **41** have been identified.
2. It is estimated that **42** or **43** of the population may develop some degree of chronic respiratory disease.
3. The major clinical presenting complaints are:
   - **44** cough
   - Hemoptysis
   - **45** emphysema
   - Diagnostic significance for this will be **46**.

In the pleura the most common form of malignancy is **47**.

The clinical manifestations of bronchial adenomas are as follows:

1. Increased numbers of cases of so-called pulmonary **48** have been identified.
2. It is estimated that **49** or **50** of the population may develop some degree of chronic respiratory disease.
3. The major clinical presenting complaints are:
   - **51** cough
   - Hemoptysis
   - **52** emphysema
   - Diagnostic significance for this will be **53**.

In the pleura the most common form of malignancy is **54**.

The clinical manifestations of bronchial adenomas are as follows:

1. Increased numbers of cases of so-called pulmonary **55** have been identified.
2. It is estimated that **56** or **57** of the population may develop some degree of chronic respiratory disease.
3. The major clinical presenting complaints are:
   - **58** cough
   - Hemoptysis
   - **59** emphysema
   - Diagnostic significance for this will be **60**.
FIGURE LEGEND

Figure 2: Listing of program (cards numbered 1-236), and of the sample data set (cards 237-342) used to generate the example of Figure 1.
TITLE CARD: QUIZ50S LISTING

PAGE NR. 1

** JOB CONTROL CARDS HERE, PRECEDING FORTRAN

** PROGRAM QUIZ50S, QUIZ SCRAMBLER, 50/20 OPTION, 26 FEB 1973.

** FIRST A LIST OF SYMBOLS, A QUIZ LEGEND, THE QUIZ IDENTIFIER ARE READ IN

** THEN RUN CONTROL CODES (SEE BELOW) ARE READ IN.

** 50 TEXT CARDS MUST BE READ IN; EVEN IF THE 50 IS PADDED OUT WITH BLANKS.

** CARDS ARE STRAIGHT TEXT, 80 COLS/CARD, USING ANY SYMBOL COMBINATIONS EXCEPT

** // OR /* (WHICH MIGHT INTERFERE WITH JCL). QUESTION NUMBERS ARE INDICATED

** BY PAIRED *", I.E. **01**, ETC. % IS USED ANYWHERE IN THE TEXT TO INDICATE

** TEXT SCRAMBLE POINTS, UP TO 50 % MAY BE USED. HOWEVER, TO AVOID BROKEN

** SENTENCES IN THE STUDENT OUTPUT, % SHOULD USUALLY BE PLACED AT THE END

** OF COMPLETE SENTENCES.

** THEN, ANSWER CARDS ARE READ IN, IN ALPHABETICAL ORDER, THE QX NR SHOULD BE

** IN COLS 162, AND THE ANSWER TEXT STARTING IN COL 3, BUT NOT EXTENDING PAST

** COL 22. THERE SHOULD BE AS MANY ANSWER CARDS AS THE VALUE OF MIX UN CONTROL

** CARD.

** IF IT IS DESIRED TO SUBSTITUTE A STUDENT-CALCULATED, NUMERICAL, ANSWER FOR

** THE RANDOM CODE, IT MAY BE ENTERED AS A RIGHT-ADJUSTED, INTEGER, NUMBER

** IN COLS 23-27 OF THE ANSWER CARD. ANY LEGEND MAY THEN BE USED IN COLS 3-22.

** E.G. "NUMERICAL ANSWER", OR "FIGURE CHOICE NR. = ".

** DIMENSION LD(5),LAA(50),LAB(50),LCD(50),LP(40),LHM(50),LBD(50),

** 1 NAME(200),L(40),LAA(50),LAD(50),LBD(4000),L(4000),LAM(50),LMA(50),LMB(50),LNC(10)

** 10 FORMAT(5X,"CHOOSE THE *BEST* ANSWER FOR EACH QUESTION, AND COPY I

** ITS CODE SYMBOL INTO THE SPACE PROVIDED BESIDE THE QUESTION",6X,6A1

** 2)

** 11 FORMAT(1I0)

** 12 FORMAT(1I1)

** 13 FORMAT(6H GRIEF)

** 14 FORMAT(5X,4OA1,"NAME="6A1,4OX,"CODE =",I5,5X,15)

** 15 FORMAT(5X,"NUMBER. USE PENCIL, AND WRITE CODE CLEARLY INTO SPACE 8 B

** 16 SIDE QUESTION NR. =",4DX,8A1)

** 16 FORMAT(84X,"CHOICE AND CODE. QX #, &")

** 17 FORMAT(80A1,15)

** 18 FORMAT(1615)

** 19 FORMAT(1X,80A1,3X,20A1,I5,3X,13,5A1,5X,15)

** 20 FORMAT(5X,1012)

** 21 FORMAT(12,20A1,15)

** 22 FORMAT(1IX,"CODE. ")

** 23 FORMAT(5X,1MASTER COPY",4110)

** 24 FORMAT(5X,4OA1,"NAME =",2X,40A1,17X,"CODE =",I5,5X,15)

** 25 FORMAT(80A1)

** 26 FORMAT (5X,80A1)

** 27 FORMAT (5X,12,20A1)

** READ SYMBOL CARD, USUALLY**0123456789% Z-----**

** READ 27, MM, LSF1, NB, LSF2, LD

** CONTINUE

** DO 37 J=1,200
NR.
51  DO 37 K=1,40
52  37 NAME(J,K)=NB
53         LL=0.0
54         JXX=3125
55  LST=2**18
56  DO 70 N=1,50
57  70 LLA(N)=0
58         NBH=NB
59  DO 69 K=1,50
60         LNA(K)=0
61  DO 69 J=1,20
62         LA(K,J)=NB
63         69 CONTINUE
64  C** READ TEST LEGEND, AND ANSWER LIST IDENTIFIER. THEN READ RUN CONST.
65  C** NSTUO=# COPIES, NQX=# ANSWERS, NS=CODE SHIFT, NSK=RANDOM NR SHIFT.
66  C** NMS=# OF MASTER COPIES TO BE PRINTED, JN/JT=CONTROL OF NUMBER/TEXT SHIFT.
67  C OPTIONS (SEE BELOW)..
68  IF(NMS.LE.0) NMS=3
69  IF(NSR.LE.0) NSR=13
70  READ IN TEXT CARD ARRAY (LQ), & ANSWER CARD ARRAY (LAA/LA/LNA)
71  READ 27,LQ
72  DO 110 K=1,NQX
73  110 READ 21, LAA(K),(LA(K,J),J=1,20),LNA(K)
74  DO 116 N=1,50
75  116 CONTINUE
76  DO 30 J=1,200
77  READ 17,(NAME(J,K),K=1,40)
78  IF (NAME(J,1).EQ.NB) GO TO 31
79  30 CONTINUE
80  31 CONTINUE
81  IF(NSR.LE.0) NSR=13
82  C** PRINT NMS MASTER COPIES, WITH ANSWERS ORDERED BY QUESTION NUMBER.
83  IF(NSTUO.EQ.0) NSTUO=1
84  DO 130 K=1,NSTUO
85  PRINT 12
86  PRINT 23, NSTUO,NQX,NS,NSR,NMS,JN,JT
87  PRINT 11
88  PRINT 29, LP,LE
89  DO 122 L=1,50
90  122 CONTINUE
91  123 CONTINUE
92  IF(NY.LE.0) NY=1
93  IF(LAM(L).EQ.L) GO TO 120
94  IF(LAM(L).EQ.0) GO TO 120
95  116 CONTINUE
96  120 NZ=NY+1
97  IF(NY.GT.4000) GO TO 128
98  122 PRINT 19,(LQ(J),J=NZ,NY),(LA(N,M),M=1,20),LNA(N),L,(LD(NN),NN=1,5)
100  1,N
23

NR. 128 NY=0
102 130 CONTINUE
103 C** SHIFT RANDOM NUMBER CHAIN ALONG BY NSR
104 DO 140 K=1,NSR
105 JXX=JXX*E5547
106 IF(JXX) 145,140,140
107 145 JXX=JXX+2147483647+1
108 140 CONTINUE
109 C** LOCATE, STORE, & BLANKOUT, THE TEXT SHIFT LOCATIONS (**). 
110 KB=0
111 KRM=0
112 DO 300 LF=1,4000
113 IF(LQ(LF).EQ.LSF2) GO TO 301
114 GO TO 300
115 301 IF(LQ(LF+1).EQ.LSF2) GO TO 302
116 GO TO 300
117 302 KB=KB+1
118 LBM(KBI)=LF
119 LQ(LF)=NRR
120 LQ(LF+1)=NRR
121 300 CONTINUE
122 C** LOCATE, AND STORE, THE QUESTION NUMBER LOCATIONS (**NR**).
123 KA=0
124 KK=0
125 DO 100 KK=1,4000
126 IF(KK.LF.KKK) GO TO 100
127 IF(LQ(KK).EQ.LSF1) GO TO 101
128 GO TO 100
129 101 IF(LQ(KK+1).EQ.LSF1) GO TO 102
130 GO TO 100
131 102 KA=KA+1
132 KAA=KA
133 LB(KA)=KK+2
134 KKK=KK+5
135 100 CONTINUE
136 C** PRINT SYMBOLS USED, & ARRAYS FOR LOCATIONS OF X%, **, & NUM. ANS.
137 PRINT 12
138 PRINT26,M,M,LSFI,NB,LSF2,LO
139 PRINT 11
140 PRINT 20, LBM
141 PRINT 11
142 PRINT 20, LB
143 IF(LA(NCK).GT.0) GO TO 103
144 PRINT 13
145 STOP 998
146 103 PRINT 11
147 PRINT 20, LNA
148 NF=NSTUO + NS
149 C** BEGIN ASSEMBLY OF COMPLETE QUIZZES.
150 DO 200 L=NS,NF
DO 66 K=1,50
LCOD(K)=0
LAB(K)=0
CONTINUE
IF(JN.NE.0) GO TO 71
C** BEGIN NUMBER SHIFT, IF JN.NE.0.
DO 67 K=1,NQX
LAAP=LAAIK)+L*NS
IF(LAAP-51) 63,64,64
LAAP=LAAP-50
CONTINUE
LAADJK)=LAAP
CONTINUE
DO 68 KA=1,KAA
NQ=NS*L+KA
IF(NQ-51) 60,61,61
NQ=NQ-50
GO TO 62
CONTINUE
VT=NS/10
NO=NS-NT*10
LG=LBA(KA)
CONTINUE
IF(JT.NE.0) GO TO 400
C** BEGIN TEXT SHIFT, IF JT.NE.0.
L3(LC)=MM(NT+1)
L0(LC+1)=MM(ND+1)
CONTINUE
IF(KB.EQ.0) GO TO 400
KBM=KBM+1
IF(KBM.LE.KB) GO TO 351
KBM=KBM-KB
GO TO 352
IF(LBM(KBM).LE.0) GO TO 400
ND=LBM(KBM)
NE=ND-1
NG=4000-NE
NH=NG+1
DO 360 KC=1,NG
LQM(KC)=L(QKC+NE)
IF(NG.EQ.3999) LQM(4000) = LQ(1)
IF(NH.GE.4000) GO TO 400
DO 362 KC=NH,4000
LQM(KC)=LQ(KC-NG)
CONTINUE
C** PRINT COMPLETE QUIZ SHEET.
PRINT 12
PRINT 10, (LE(MN),MN=1,6)
PRINT 15, (LE(MN),MN=7,12)
BRONCHOCENIC CARCINOMA IS **01** AMONG THE GREAT VARIETY OF TUMORS OF THE LUNG. THERE IS A DIRECT CORRELATION BETWEEN THE FREQUENCY OF LUNG CANCER AND:

1. THE AMOUNT OF **02**;
2. THE TENDENCY TO **03**;
3. THE DURATION OF THE *

TUMORS ARE THE HOST OF ALL FORMS AND HAVE THE POOREST.

MAJOR CLINICAL PRESENTING COMPLAINTS ARE: CHEST PAIN; AND CHEST PAIN, 40%. SCATTERED REPORTS HAVE INDICATED A CURIOUS ASSOCIATION BETWEEN BRONCHOGENIC CARCINOMA AND CERTAIN, PARTICULARLY, AS WELL AS GYNECOMASTIA.

INCREASING NUMBERS OF CASES OF SO-CALLED PULMONARY HAVE BEEN IDENTIFIED.

THE CLINICAL MANIFESTATIONS OF BRONCHIAL ADENOMAS EMANATE FROM THEIR CAPACITY AND THE ABILITY OF SOME OF THESE LESIONS TO ELABORATE.

THE MALIGNANT NEOPLASMS OF THE LARYNX ARE ALMOST INVARIABLY CELL CARCINOMA. ARE SMOOTH, ROUNDED, SESSILE OR PEDUNCULATED NODULES THAT RARELY EXCEED 1 CM. IN DIAMETER, AND OCCUR MOST OFTEN ON THE TRUE VOCAL CORDS.

ISOLATED MAY ARISE IN THE LYMPHATIC STRUCTURES ADJACENT TO THE NOSE AND SINUSES. THESE PLASMACYTOMAS MAY OCCUR AS APPARENTLY ISOLATED TUMORS UNRELATED TO SYSTEMIC NEOPLASIA.

THE CARCINOMA IS CHARACTERIZED HISTOLOGICALLY BY STRANDS AND MASSES OF POLYGONAL OR SPINDLE CELLS GROWING WITHIN A FIBROUS STROMA. IN MANY OF THESE GROWTHS THERE IS AN ABUNDANT LYMPHOID INFILTRATE WITHIN THE FIBROUS STROMA, DESIGNATED, THEN, AS A.

FROM FIGURE 'A' THE MOST COMMON SITE OF VISCERAL MALIGNANCY IN WESTERN MALES IS THE. WITH DOMINATING THE MALIGNANT MORTALITY AT THIS SITE. CURVE 282 NT U.S. MALE, WHITE, MALIGNANT MORTALITY AT THIS SITE IS ABOUT 283 WITH AN INCIDENCE 284 INDICATIVE OF A CURE RATE. FURTHERMORE, THE U.S. WHITE, MALE MORTALITY RATE AT THIS SITE IS RISING AT A RATE OF ABOUT 285 SO THAT ONE MAY ANTICIPATE A TOTAL MALIGNANT MORTALITY AT THIS SITE OF ABOUT 286 FOR THE POPULATION OF 100 MILLION WHITE MALES EXPECTED IN 1975.

FROM FIGURE 'B' THE STRUCTURAL FORMULA OF THE COMPOUND ASSOCIATED WITH THE CARCINOID SYNDROME OF SOME BRONCHIAL ADENOMAS IS. ITS URINARY METABOLITE IS. A URINARY LEVEL OF MAY BE CONSIDERED DIAGNOSTICALLY SIGNIFICANT FOR THIS METABOLITE.
27

NR.

201 2OCUSHING'S SYNDROME
202 02DAILY SMOKING
203 18DYSPEA
204 19ENDOCRINE DISEASES
205 08EXTRACTS OF TOBACCO
206 09HILUS OF THE LUNG
207 03INHALF
208 25INTRALUMINAL GROWTH
209 32LUNG AND BREAST
210 40LYMPHOMA
211 24MALIGNANT NEOPLASMS
212 26METASTASIZE
213 31MESOTHELIOMA
214 44ONLY SLIGHTLY
215 36PAPILLOMA
216 37PLASMACYTOMAS
217 38PLASMA CELL
218 34POLYPS OF THE LARYNX
219 35POLYPS
220 45POOR
221 01PREEMINENT
222 30PRIMARY MALIGNANCY
223 15PROGNOSIS
224 14RAPIDLY GROWING
225 41RESPIRATORY SYSTEM
226 29SECONDARY METASTATIC
227 04SMOKING HABIT
228 115QUAMOUS CELL
229 33SQUAMOUS
230 07TOBACCO SMOKE
231 39TRANSITIONAL CELL
232 13UNDIFFERENTIATED
233 17WEIGHT LOSS
234 275-HYDDXYTRYPTAMINE
235 43NUMERICAL ANSWFR 57
236 46NUMERICAL ANSWER 16
237 47NUMERICAL ANSWER 65000
238 50NUMERICAL ANSWER 10
239 48FIGURE CHOICE, NR. = 3
240 49FIGURE CHOICE, NR. = 5
241 NAMELIST HERE
242

NAMELIST HERE
FIGURE LEGEND

Figure 3: Program flow Diagram, with statements keyed to the card numbers of Figure 2.
REFERENCES


